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F4T TGT
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(56) Documents Cited
GB 2138120 A GB 1092534 A EP 0314928 A1
US 4274587 A

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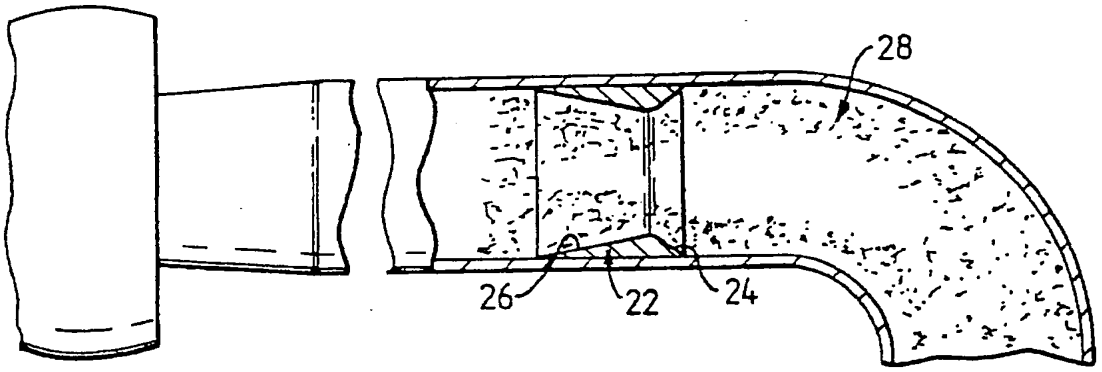
(54) **Pulverised fuel flow re-distributor**

(57) A flow re-distributer provides a ramp (22) in the ducting through which air entrained, pulverised coal passes from a mill (10) Fig 1 (not shown) to burners (12). The ramp (22) has a throat which deflects the flow away from the walls of the duct and in doing so, obviates any streams that the pulverised coal may have separated into as a result of passing around the bends in the ducting. The portion of the ramp 26 downstream of the throat enables redistribution of the fuel flow into an evenly spread stream. Flow straightening vanes (34) Fig. 3 (not shown) may be positioned in the ramp, and may extend downstream thereof.

Fig.2



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

Fig.1

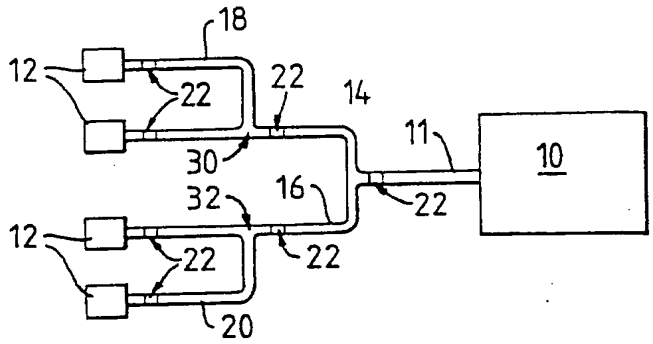


Fig.2

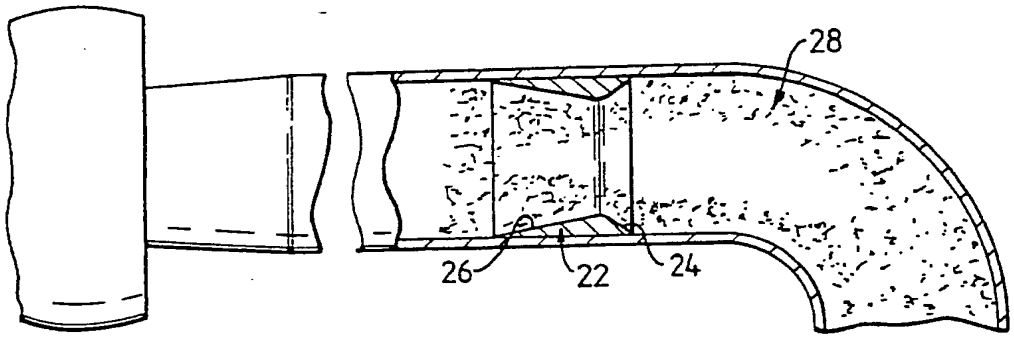


Fig.3

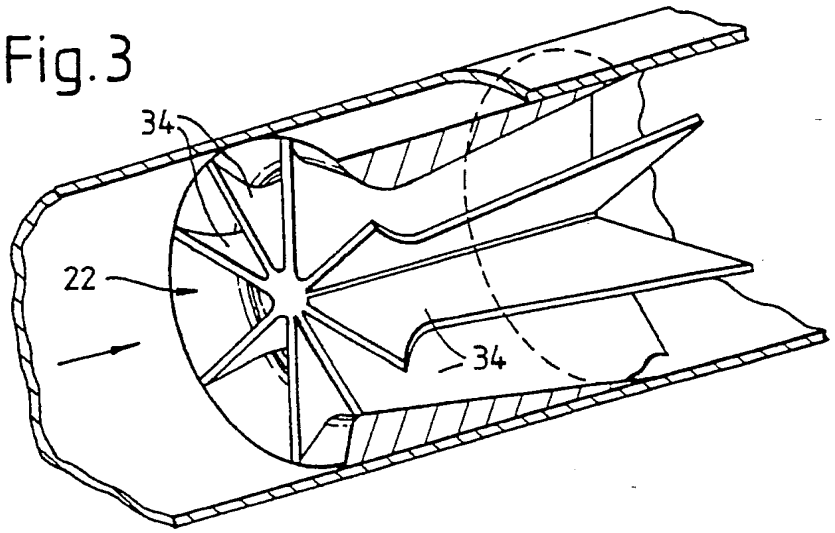


Fig.4.

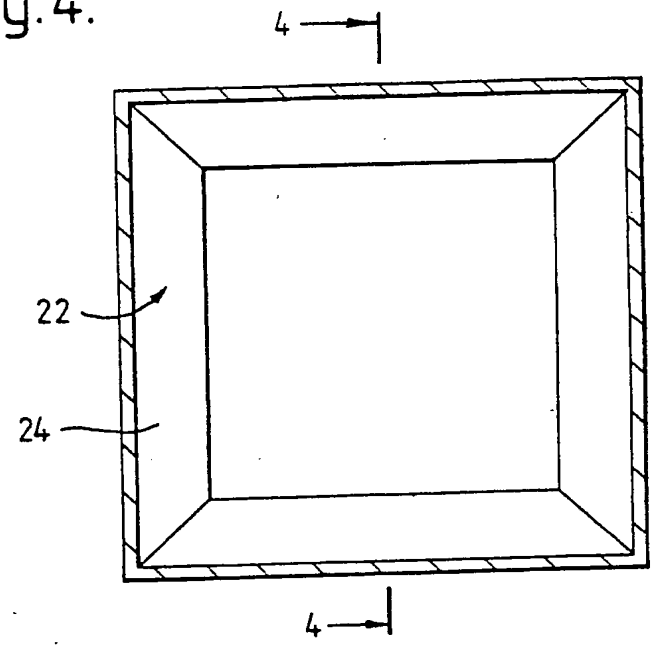
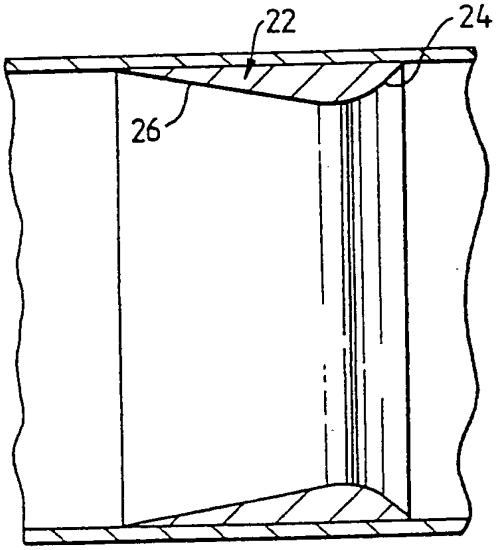


Fig.5.



PULVERISED FUEL FLOW RE-DISTRIBUTOR

The present invention relates to a distributor for achieving a desired flow characteristic in a flow of pulverised fuel in ducting.

The device has particular efficacy when used in the flow of pulverised coal which is passed via ducting from a mill to the burners of steam generating plant.

The method practised for feeding the flow through the ducting comprises entraining the pulverised coal in a flow of air through the ducting. A main drawback is that, invariably, the ducting connecting the mill to the burners has a plurality of bends within its length and further, has a plurality of branches via which pulverised coal is passed from the initial portion of the ducting to each one of a number of burners.

The bends create flow characteristics in the pulverised fuel which are exemplified by the coal flow dividing into a number of ropelike streams which travel along the wall surface of the ducting. Such a flow pattern obviates any chance of achieving correct proportional separation of the flow at branch and burner inlets.

The present invention seeks to provide apparatus with which to restore even distribution of a flow of pulverised fuel in a ducted airflow prior to its delivery to a burner and/or branch ducts.

According to the present invention an air entrained pulverised fuel flow re-distributor comprises a duct containing a ramp which extends completely peripherally over the duct and axially thereof, said ramp having an upstream face which diverges towards the duct wall in an upstream direction and a downstream face which diverges towards the wall of the duct in a downstream direction, said faces being joined at adjacent ends to form a throat.

The invention will now be described by way of example and with reference to the accompanying drawings,

in which:

Fig 1 is a diagrammatic layout of a fuel pulverising mill coupled to a plurality of burners via ducting containing re-distribution means in accordance with the present invention.

Fig 2 is an enlarged axial cross sectional view of part of the ducting of Fig 1.

Fig 3 is a pictorial part view of an embodiment of the redistribution means of Fig 1.

Fig 4 is a view of a further embodiment of the redistribution means of Fig 1.

Fig 5 is a view on line 5-5 of Fig 4.

Referring to the drawings. In Fig 1 a mill 10 is connected to a number of pulverised fuel burners 12 via ducting 11, 14, 16, 18 and 20 respectively. Ducts 18 and 20 are branch lines from ducts 14 and 16 respectively.

In operation, pulverised coal is taken from the mill 10 in an airstream in known manner and passed via the ducting to the respective burners 12.

During its passage through the ducting, the coal/air mix passes over a number of ramps 22 at preselected places in the ducting.

Referring to Fig 2. Each ramp is in the form of a venturi in that it includes a flow contracting surface 24 which faces upstream with reference to the direction of the flow of coal/air, and an expansion surface 26 which faces downstream of the coal/air flow. The ramp is proportioned so that the coal/air flow passing over it is first forced to flow towards the axis of the duct containing the ramp 24 and then expand in a manner which ensures a substantially evenly distributed flow pattern cross sectionally of the duct, downstream of the ramps. The pulverised coal is indicated generally by the numeral 28.

The ramps 22 are positioned closely upstream of points in the ducting where it is essential that the coal/air flow is evenly distributed across the duct,

thus, referring back to Fig 1 a ramp is positioned closely upstream of the bifurcation of duct 11 into ducts 14 and 16. The presentation of the even coal/air flow to the bifurcation ensures a substantially equal division of the flow into the ducts 14 and 16.

Ramps 22 are also positioned in ducts 14 and 16, upstream of respective junctions 30, 32 from which ducts 18 and 20 branch and downstream of bends in the ducts. Here the resulting even coal/air flow after passing through ramps 22 ensures that sufficient of the flow passes across the inlets to ducts 18 and 22 as to pass into those ducts in regular manner.

Ramps 22 are also positioned upstream of each burner 12, which is downstream of the branch junctions.

As regards ducts 18 and 20, the coal/air flows have had to negotiate further bends which reintroduces the ropelike formations in the pulverised coal. The ramps 22 which are positioned downstream of those respective bends will re-combine those formations and then expand the resultant single column as described hereinbefore, and thus present the coal/air flows in regular manner to the inlets of the burners.

Those ramps 22 which are positioned just upstream of the burners 12 at the ends of ducts 14 and 16 have only to re-distribute the respective coal/air flows which have passed the inlets to the branch ducts 18 and 20 and which may have become irregular by virtue of having reduced mass flow, some portions of the coal/air flows having passed into the branches.

Experiment has shown that, where the ducting is circular in cross section, the following parameters are useful in deciding the dimensions of the re-distributor ramp 22 and its position relative to that place which is to receive the re-distributed coal/air flow, eg a burner 12.

Where 'd' is the bore diameter of the duct, then the overall length of the ramp 22 should be 0.54 d and the

throat diameter of the ramp should be 0.84 d.

The upstream face of the ramp 22, which is frusto conical in circular cross section ducts, should diverge in a direction away from the axis of the duct in a n upstream direction, at a nominal angle of 50°, and the downstream face of the ramp 22 should diverge in a direction away from the axis of the duct and in a downstream direction at a nominal angle of 78°. The upstream and downstream faces should be joined by a blending radius of 0.125 d.

For operation the ramp is positioned 3.5 d to 4.0 d from the inlet to the burner 12 and each bifurcation.

The dimensions stated herein should be regarded as nominal, since plants which incorporate the principle of the present invention may be designed to operate coal/air flows of widely varying mass flow rates. Other operating parameters may also change, one plant to another.

The invention also has efficacy when utilised in square section ducting, as is depicted in Figs 4 and 5. In those examples the dimensional proportions of the frame defined by the ramp square are related to the length 'L' of sidewalls of the bore of the duct and have the same relative values, ie 0.54 L, 0.84L and 0.125L. Moreover the upstream and downstream faces of the ramp 22 have the same angular relationship as those of device 22.

Some plants have burner and mill connections which are achieved by ducts which have compound curves within their lengths. Such shapes tend to generate a swirling movement in the airflow, which should be obviated before reaching the burners along with its pulverised coal. To this end the ramps 22 may be provided with flow straightening vanes 34 as is seen in Fig 3.

The vanes 34 are depicted as starting at the plane of the inlet to the ramp 22, so that straightening and concentration of the flow start simultaneously. However, if desired, the vanes may be extended in an upstream direction so that the overall length of vanes 34 and ramp

22 is, nominally, 0.75 d or, in the case of the square duct, 0.75L. The latter arrangement achieves at least some flow straightening prior to the coal/air flow entering the ramp 22.

The ramps 22 may be formed by depressing the walls of the ducts with a suitable tool. Alternatively, the ramps 22 may be cast or machined and fixed in the ducts by pins (not shown) or other like fixings. The latter method would enable replacement when the throat becomes too large through erosion.

Claims:-

1. An air entrained pulverised fuel flow re-distributor comprising a duct containing a ramp which extends completely peripherally of said duct and axially thereof, said ramp comprising an upstream face which diverges towards the wall of the duct in an upstream direction and a downstream face which diverges towards the wall of the duct in a downstream direction, the two diverging faces being joined to form a throat.

2. An air entrained pulverised fuel flow re-distributor as claimed in claim 1 wherein the downstream face is longer than the upstream face.

3. An air entrained pulverised fuel flow re-distributor as claimed in claim 1 or claim 2 wherein said throat is defined by a blending radius which joins the two faces.

4. An air entrained fuel flow re-distributor as claimed in any previous claim wherein a plurality of vanes are arranged in equi angular relationship within the ramp and extend for its full length.

5. An air entrained pulverised fuel flow re-distributor as claimed in claim 4 wherein said vanes extend beyond the inlet end of the ramp.

6. An air entrained pulverised fuel flow re-distributor as claimed in any previous claim wherein said duct is of circular cross section.

7. An air entrained pulverised fuel flow re-distributor as claimed in any of claims 1 to 5 wherein the duct is of square cross section.

8. An air entrained pulverised fuel flow re-distributor substantially as described in this specification and with reference to Figs 1 to 3 of the accompanying drawings.

9. An air entrained fuel flow re-distributor substantially as described in this specification and with reference to Figs 4 and 5 of the accompanying drawings.

Amendments to the claims have been filed as follows

1. An air entrained pulverised fuel flow re-distributor comprising a duct containing a ramp which extends completely peripherally of said duct and axially thereof, said ramp comprising an upstream face which diverges towards the wall of the duct in an upstream direction and a downstream face which diverges towards the wall of the duct in a downstream direction, the two diverging faces being joined by a blending radius to form a throat and including a plurality of flow straightening vanes arranged equi-angularly around the ramp and extending for at least the full length thereof.

2. An air entrained pulverised fuel flow re-distributor as claimed in claim 1 wherein said vanes extend beyond the inlet end of the ramp.

3. An air entrained pulverised fuel flow re-distributor as claimed in any previous claim wherein said duct is of circular cross section.

4. An air entrained pulverised fuel flow re-distributor as claimed in claim 1 or claim 2 wherein the duct is of square cross section.

5. An air entrained pulverised fuel flow re-distributor substantially as described in this specification and with reference to Figs 1 to 5 of the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report) -8-

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Relevant Technical fields

(i) UK Cl (Edition K) F4T (TGT,TDA,TDD,TDX,TGBX) G3H (HAA,HEA) B8A

(ii) Int Cl (Edition 5) F23D, B65G

Search Examiner

R L WILLIAMS

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

6 JANUARY 1992

Documents considered relevant following a search in respect of claims 1-9

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2138120 A (FOSTER WHEELER) note Figure 2	1-3
X	GB 1092534 (NUCLEAR POWER PLANT ET AL) note Figure 1	1-3
X	EP 0314928 A1 (BABCOCK-HITACHI KK) note Figure 11	1-3
X	US 4274587 (P L CIOFFI ET AL)	1-3

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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